CLAIMS

1. Process for depositing, by electron cyclotron resonance plasma, a web of carbons nanofibres or nanotubes onto a substrate without any catalyst, by injection of a microwave power into a deposition chamber comprising a magnetic structure with a highly unbalanced magnetic mirror and at least one electron cyclotron resonance zone within the interior of the said deposition chamber itself and opposite the said substrate, in which, under a pressure less than 10^{-4} mbar, the ionisation and / or dissociation of a gas containing carbon is induced in the said magnetic mirror in the centre of the deposition chamber, thus producing species that deposit on the said substrate, which is heated.

2. Process according to claim 1, comprising the following steps:

- heating the substrate
- establishing a pressure less than or equal to 10^{-4} mbar of a gas containing carbon
- injecting the microwave power, and creating the plasma from the said gas containing carbon, for a value of the magnetic field corresponding to the electron cyclotron resonance
- creating a potential between the plasma and the substrate
- dissociating and / or ionising the molecules in the said magnetic mirror at the centre of the deposition chamber

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- depositing the species formed on the said substrate in order to obtain a web of carbon nanofibres or nanotubes.

3. Process according to claim 2, in which the steps are carried out simultaneously.

4. Process according to any of claims 1 to 3, in which the deposited carbon is a graphite type carbon with a minority proportion of sp3 bonds and a majority proportion of sp2 bonds.

5. Process according to claim 1, in which the said structure of the magnetic mirror is such that the magnetic field is maximum (B_{max}) at the microwave injection, then the magnetic field is minimum (B_{min}) at the centre of the deposition chamber and finally the magnetic field increases on the substrate ($B_{substrate}$).

6. Process according to claim 1, in which the mirror ratio upstream at the microwave injection, defined by $r_1 = B_{max}$ (in Gauss) / B_{min} (in Gauss) is greater than 4.

7. Process according to any of claims 1 to 6, in which the mirror ratio, downstream towards the substrate, defined by $r_2 = B_{substrate}$ (in Gauss) / B_{min} (in Gauss) is greater than or equal to 1.5.

8. Process according to any of claims 1 to 7, in which the substrate is heated to a temperature of 500 °C to 750 °C.

9. Process according to any of claims 1 to 8, in which the pressure is less than or equal to 8.10^{-5} mbar.

10. Process according to any of claims 1 to 9, in which the said gas containing gas is chosen from methane,

ethane, ethylene, acetylene, and their mixtures, possibly supplemented with hydrogen.

11. Process according to claim 1, in which the heating of the substrate is achieved by electron bombardment or external heating.

12. Process according to claim 1, in which the injection of the microwave power takes place at a frequency of 2.45 GHz.

13. Process according to claim 1, in which the substrate is positively polarised, for example from + 20 volts to + 100 volts, and the plasma is connected to frame.

14. Process according to claim 1, in which the plasma is negatively polarised, for example from - 20 to - 100 volts and the substrate is connected to frame.

15. Device for depositing, by electron cyclotron resonance (ECR) plasma, films of carbon nanofibre webs onto a substrate without a catalyst, the said device comprising:

- a deposition chamber
- the means for creating a magnetic structure with a strongly unbalanced magnetic mirror in the said deposition chamber
- an electron cyclotron resonance zone within the interior of the said deposition chamber and opposite the said substrate
- the means for injecting a microwave power into the said deposition chamber

- the means for creating a pressure less than 10^{-4} mbar of a gas containing carbon within the interior of the said deposition chamber

16. Device according to claim 15 comprising, in addition, the means for heating the substrate.

17. Device according to either of claims 15 and 16 comprising, in addition, the means for creating a potential difference between the plasma and the substrate.

18. Film, which may be on the substrate, formed of a web or network of interconnected carbon nanofibres or nanotubes, like a spider's web, the said film being free of any catalyst.

19. Film according to claim 18, in which the carbon is a graphite type carbon with a minority proportion of sp3 bonds and a majority proportion of sp2 bonds.

20. Film according to either of claims 18 or 19, in which the web or network has an average mesh size of from one or several tens of nm to one or several hundreds of nm, for example from 20 to 200 nm.

21. Film according to any of claims 18 to 20, in which the average diameter of the nanofibres or nanotubes is from one or several nm to one or several tens of nm, for example from 1 to 100 nm.

22. Structure with several layers - or multi-layer structures - comprising at least two layers of carbon nanofibre or nanotube webs according to any of claims 18 to 21.

23. Filter comprising at least one film according to any of claims 18 to 21 or at least one multi-layer structure according to claim 22, which may be on a substrate.

24. Filter according to claim 23, in which the said film or multi-layer structure is spread out over a rigid grid with larger mesh size.

25. Electron accelerating or decelerating nanogrid comprising at least one film according to any of claims 18 to 21, or at least one multi-layer structure according to claim 22.

26. Flat screen, in particular with large dimensions, comprising a film according to any of claims 18 to 21, or at least one multi-layer structure according to claim 22, which may be on a substrate.

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